AD-A096 519 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG--ETC F/G 9/2
H2250-RESERVOIR STORAGE DRAWDOWN TIME, PROGRAM NUMBER 722-F3-R0--ETC(U
FEB 79 B J BROWN

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ELECTRONIC COMPUTER PROGRAM ABSTRACT

TITLE OF PROGRAM: H225Ø - Reservoir Storage Drawdown Time	PROGRAM NO. 722-F3-RØ-2DØ

PREPARING AGENCY Hydraulics Analysis Division, Hydraulics Laboratory, U. S. Army Engineer Waterways Experiment Station, P. O. Box 631, Vicksburg, MS 39180

AUTHOR(S)	DATE PROGRAM COMPLETED	STATUS OF PROGRAM: PHASE	STAGE
Bobby J. Brown	February 1979	Origin	Operational

A. PURPOSE OF PROGRAM

To compute the drawdown time (hrs) of a reservoir from a given upper pool elevation to a specified lower pool elevation given either a constant inflow (may be zero) or an inflow hydrograph

B. PROGRAM SPECIFICATIONS

SEE FOLLOWING PAGES.

C. METHODS

The program is written in G635 time-share series, FORTRAN IV, and is part of a Conversationally Oriented Real-Time Program-Generating System (CORPS). The program consists of a main program and a subroutine. The main program handles all I/O requirements and computations. The subroutine performs all writing and file requirements to save the output for graphics and/or other use if requested.

D. EQUIPMENT DETAILS

The program was developed and is operational on the WES G635, Vicksburg, MS. It is also operational on HIS 66/8Ø, Macon, GA, and Boeing CDC, Seattle, WA.

E. INPUT-OUTPUT

Input requirements are: Either constant (may be zero) or inflow hydrograph; time in hours, flow rate in acre-ft/hr, loss coefficient of outlet conduit, initial and final gage heights of reservoir water surface in ft above outlet intake invert, and coefficients of power curve to data of gage height (ft) versus reservoir storage (acre-ft). Output includes given data and the values of inflow, outflow, storage, and gage height of water surface for each time step.

F. ADDITIONAL REMARKS

Complete documentation of this program is available from the Engineer Computer Programs Library, Technical Information Center, WES.

B. PROGRAM SPECIFICATIONS:

LANGUAGE: ANSI FORTRAN (FORTRAN IV)

Solution Requirements: The run command

RUN WESLIB/CORPS/H225∅,R

and the inputs defined in (E).

Method of Analysis: Numerical solution of the level pool routing-lumped-form of the continuity equation.

Core Requirements G635: 13 K words

External Storage:

1. If input is to be entered for an inflow hydrograph and the user has no existing hydrograph file, the program will create and save the user named hydrograph file. The file limits will be from 640 to 12K G635 words.

2. If the output is to be saved for graphics and/or other use, then the program will create and save the user named output file with limits from 64∅ to 12 K G635 words.

Restrictions: None

General Equation: Continuity equation discretized over a time interval (Δt)

$$\frac{1}{2}(I_1 + I_2) - \frac{1}{2}(O_1 - O_2) = \frac{V_2 - V_1}{\Delta t}$$

where I, O, and V are inflow, outflow, and volume, respectively, and the subscripts 1 and 2 indicate the start and end of the time interval (Δt).

Range of Quantities:

Unlimited

Accuracy: Same order of magnitude as the accuracy of the gage height versus storage relation.

REF: ER 1110-1-10 - ENGINEERING AND DESIGN - Engineering and Computer Program Library Standards and Documentation, Appendix B

PART I: ENGINEERING DESCRIPTION

1. PROGRAM NUMBER: 722-F3-RØ-2DO

2. TITLE: H2250 - Reservoir Storage Drawdown Time

3. REVISION LOG: N/A

4. PURPOSE OF PROGRAM: To compute the time required to draw down a reservoir from some upper pool elevation to a lower pool elevation given either a constant inflow (may be zero) or an inflow hydrograph.

5. STEP SOLUTION:

a. Input. The input variables that must be supplied upon request are:

(1) Type of inflow. Either constant (may be zero) or an inflow hydrograph. If constant, the value must be supplied (acre-ft/hr), however, if a hydrograph is used, a data file must either be created or a data file from a previous run may be used. If a data file does not exist, the program will furnish instruction on how the user may create the file. These instructions include: requests for data file name, number of points on hydrograph, and the values of time versus discharge. If a data file already exists, the name of the file is requested.

(2) The loss coefficient of the outlet conduit defined by:

$$Q = A\sqrt{\frac{2gh}{K}} \tag{1}$$

where K is the loss coefficient, Q is the discharge, A is the cross-sectional area of the outlet conduit, and h is the head or gage height (ft above intake invert), and g is the acceleration of gravity. See program H2251, which may be used to compute the loss coefficient of an outlet conduit from prototype measurements of drawdown.

(3) The cross-sectional area of the outlet conduit, ft^2.

(4) The initial gage height of the water surface at which drawdown begins (feet above datum used to determine loss coefficient in (2) above).

(5) The final gage height of the water surface, ft.

(6) The coefficients of a power curve fit to the plot of gage height (ft) versus reservoir volume (acre-ft). A straight line is fitted to the log-log plot and the equation has the form:

$$Y = CX^D \tag{2}$$

where Y is the reservoir volume (acre-ft), X is the gage height of water surface (same datum as in (2) and (4) above) and C and D are the coefficients required by the program. If one straight line does not fit the data over the range of gage heights, straight line segments of best fit should be used. If the drawdown limits overlap segments, the problem must be solved in steps, where the initial and final gage heights for each step lie on one segment and the respective C and D coefficients are used for that step. Thus, the final gage height for one step would become the initial gage height for the succeeding step.

(7) Desired type of output. The user has an option on the amount of printout. Either a detailed printout of gage height, inflow, storage, and outflow for each time step or a printout of these parameters for the initial and final time steps are available. Furthermore, for the detailed printout, the user may specify the time step increments.

b. Theoretical Formulation: The level pool routing technique is used to describe the movement of water through the reservoir. The procedure follows from the lumped form of the water continuity equation,

$$I - O = \frac{d\mathbb{V}}{dt} \tag{3}$$

where I is the inflow, O is the outflow and $\mathbb{V}$ is the reservoir storage or volume.

Equation 3, discretized over a time interval Δt is

$$\frac{1}{2}(I_1 + I_2) - \frac{1}{2}(O_1 + O_2) = \frac{V_2 - V_1}{\Delta t} \tag{4}$$

where the subscripts 1 and 2 indicate the start and end of the time interval, respectively. Equation 4 can be expressed as

$$\frac{V_2}{\Delta t} + \frac{O_2}{2} = \frac{V_1}{\Delta t} + \frac{O_1}{2} - O_1 + \frac{1}{2}(I_1 + I_2) \tag{5}$$

Define

$$N = \frac{V}{\Delta t} + \frac{O}{2} \tag{6}$$

Equation 5 reduces to

$$N_2 = N_1 - O_1 + \frac{1}{2}(I_1 + I_2) \tag{7}$$

The data consists of the inflow hydrograph and of a relation between outflow and storage. The inflow hydrograph is discretized in time to yield a series of I values.

c. Steps in Program Execution.

(1) Input variables defined.

(2) Given the initial gage height (head on outlet conduit) the initial value of outflow is computed by

$$Q = 0.08264A\sqrt{\frac{2gh_1}{K}} \tag{8}$$

where Q is the outflow in acre-ft/hr, A is the cross-sectional area of the outlet conduit (ft^2), g is the acceleration of gravity (32.2 ft/sec^2), h_1 is the initial gage height (datum is taken at the outlet intake invert) and K is the outlet conduit's loss coefficient.

(3) The initial storage or volume of the reservoir is computed,

$$\forall = Ch_1^D \tag{9}$$

where $\forall$ is the storage in acre-ft, h is the initial gage height, and C and D are the coefficients of the power fit curve of gage height versus storage.

(4) The initial N value (N_1) is computed with equation 6. The time step (Δt) used in the computations is set at 1 hour for the conditions of constant inflow and it is set at the time interval of the inflow hydrograph for the hydrograph condition.

(5) Given the inflow hydrograph (I values), the updated N value (N_2) is computed with equation 7.

(6) With N_2 known, solve for h_2 by noting that

$$N_2 = \frac{Ch_2^D}{\Delta t} + 0.0826A\sqrt{\frac{2g}{K}}\left(h_2\right)^{1/2} \tag{10}$$

or

$$ah_2^D + bh_2^{1/2} - N_2 = 0 \tag{11}$$

where $a = 0.0826A\sqrt{\frac{2g}{K}}$ and $b = \frac{C}{\Delta t}$.

Equation 11 is solved by a first order Newton technique, i.e.,

$$F(h) = ah_2^D + bh_2^{1/2} - N_2 \tag{12}$$

and the derivative with respect to h ,

$$F'(h) = aDh_2^{D-1} + \frac{1}{2}\,bh_2^{-1/2} \tag{13}$$

Initially the value of h_2 is assigned the value of h_1 and by iteration, i.e.,

$$h_2^* = h_2 - \frac{F(h)}{F'(h)} \tag{14}$$

the new approximation (h_2^*) is obtained. Iteration using equations 12, 13, and 14 is continued until

$$\left| h_2^* - h_2 \right| \leq 0.01 \tag{15}$$

or for 200 iteration.

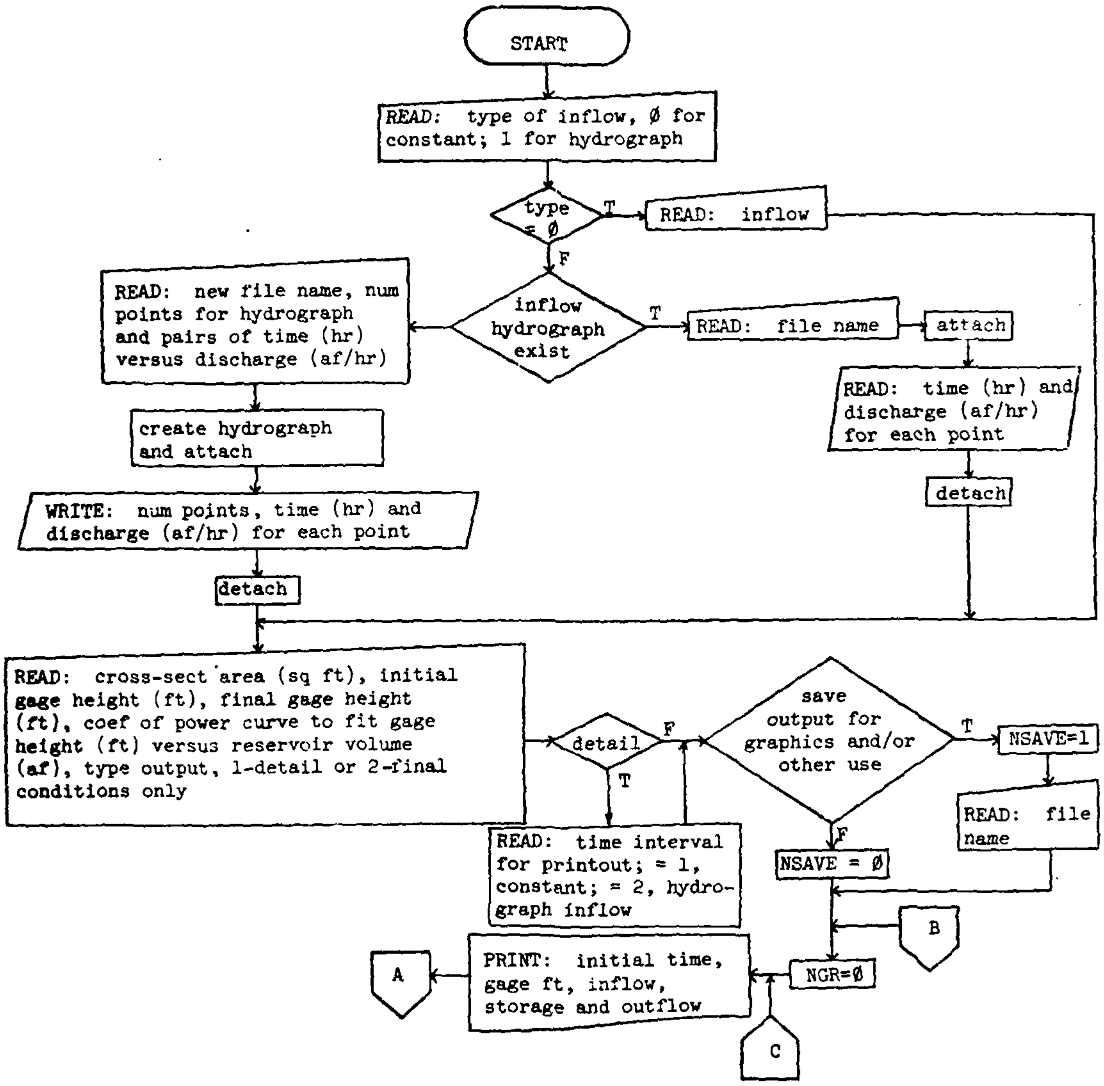
(7) With h_2 determined, the values of storage ($\forall_2$) and outflow (O_2) are computed by equations 9 and 8, respectively. Set $\forall = \forall_2$ and $O_1 = O_2$ and repeat for the next h .

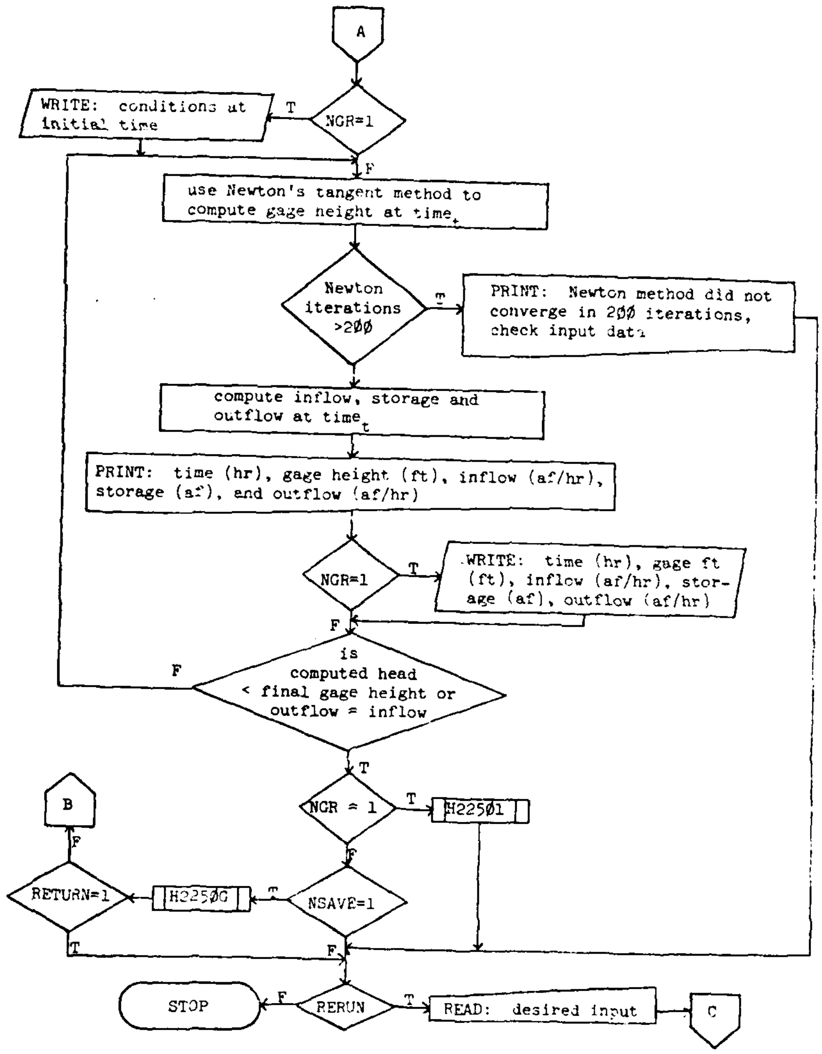
(8) Termination criteria is when the value of h_2 is less than the lower limit of gage height supplied as input or when the outflow equals the inflow.

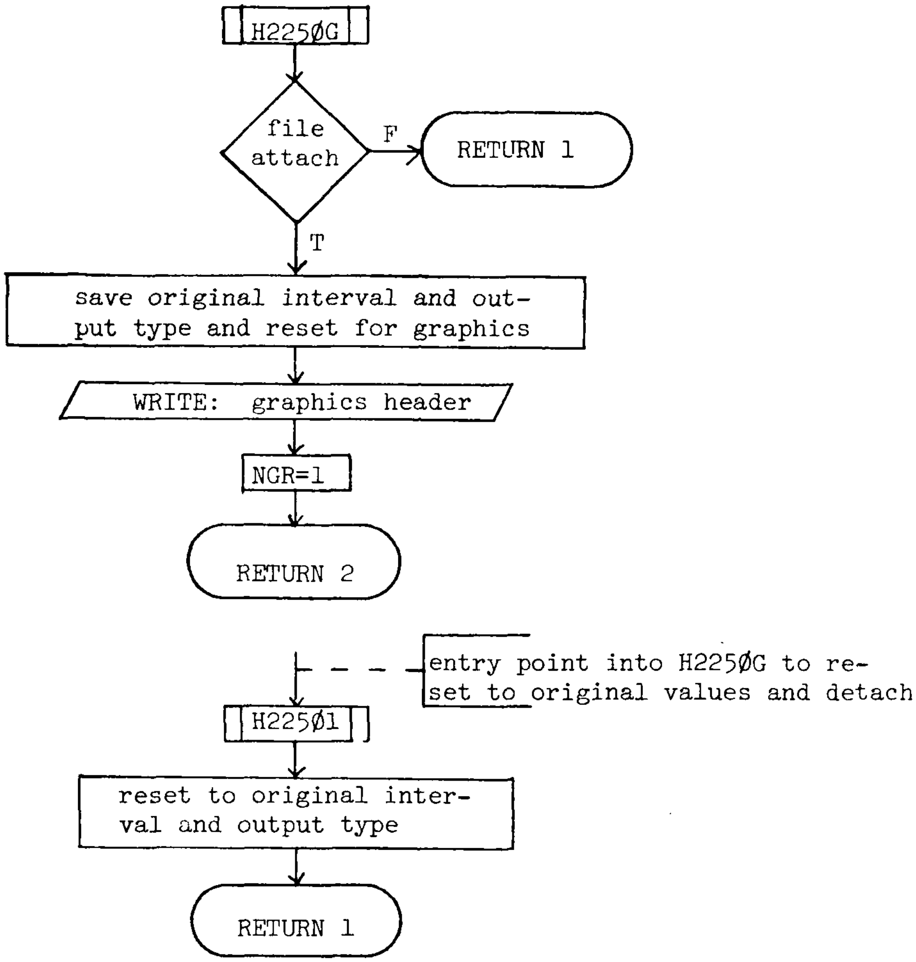
PART II: COMPUTER FUNCTIONAL DESCRIPTION

1. REVISION LOG: N/A

2. FUNCTIONAL FLOW CHART:




A
WRITE: conditions at initial time
NGR=1
use Newton's tangent method to compute gage height at time$_t$
Newton iterations >2ØØ
PRINT: Newton method did not converge in 2ØØ iterations, check input data
compute inflow, storage and outflow at time$_t$
PRINT: time (hr), gage height (ft), inflow (af/hr), storage (af), and outflow (af/hr)
NGR=1
WRITE: time (hr), gage ft (ft), inflow (af/hr), storage (af), outflow (af/hr)
is computed head < final gage height or outflow = inflow
NGR = 1
H225Ø1
B
RETURN=1
H225ØG
NSAVE=1
STOP
RERUN
READ: desired input
C
T
F


H225ØG
file attach
F
RETURN 1
T
save original interval and output type and reset for graphics
WRITE: graphics header
NGR=1
RETURN 2
entry point into H225ØG to reset to original values and detach
H225Ø1
reset to original interval and output type
RETURN 1

3. EQUIPMENT AND OPERATING SYSTEM: The program was developed on a G635 time-share system in which input/output equipment consisted of a Model 33 remote teletype. It is now operational on the WES/G635, Vicksburg, MS; HIS 66/8Ø, Macon, GA; and Boeing CDC, Seattle, WA.

4. INPUT REQUIREMENTS: All required inputs, except for the case where the user has an existing hydrograph input data file, are entered via the user's time-share terminal device in free-field format.

5. SECONDARY STORAGE INPUT: The following is the format setup for the user's hydrograph input data file. If the user has no existing hydrograph file, then the program will create and save the user named hydrograph file. All line numbers are three digit.

Line 1   FORMAT(4X,A5,1X,I3)

Equal to H2Ø5Ø followed by the number of points (NP) in the hydrograph. Must always have H2Ø5Ø since it is used by WESLIB routine TACHFILE to verify that the file is an input data file for program H2Ø5Ø

```
1ØØ H2Ø5Ø 19
```

Line 2   FORMAT(3X,2(1X,F1Ø.2))

This format controls the remainder of the data file. Each line will contain one value of time and one value of discharge. The number of lines will be equal to the number of points (NP) as given for the hydrograph.

```
1Ø2        Ø.ØØ     Ø.ØØ
1Ø4        1.ØØ     6.61
 .
 .
 .
2NP+1ØØ   18.ØØ     Ø.ØØ
```

6. <u>INPUT DATA DESCRIPTION</u>: The following names are used for the input variables in program H2Ø5Ø.

AC	- outlet conduit cross-sectional area, ft^2
CD	- loss coefficient of outlet conduit
CI	- constant inflow, af/hr
COEFFA	- coefficient of power equation for gage height (ft) versus reservoir storage, af/ft
COEFFB	- coefficient of power equation for gage height (ft) versus reservoir storage, af/hr
FILEK(1)	- 8 character, dimension max 2; name of input data file
HI	- initial gage height of reservoir water surface, ft
HF	- final gage height of reservoir water surface, ft
IPR	- time step increment for printout
NP	- number of points on inflow hydrograph, $\leq$1ØØ
NT	- type of inflow, Ø - constant; 1 - hydrograph
OUTPUT	- integer; type of output, 1 - detail; 2 - final conditions only
Q(I)	- dimension max 1ØØ; inflow values of hydrograph, af/hr
T(I)	- dimension max 1ØØ; time values of hydrograph, hr

7. <u>OUTPUT DATA DESCRIPTION</u>: The following names are used for the output variables in program H2Ø5Ø.

H2	- gage height of reservoir water surface at end of time step, ft
HI	- initial gage height of reservoir water surface, ft
O1	- inflow at initial time step, af/ft
O2	- inflow at end of time step, af/hr

Q2 - outflow at end of time step, af/hr

QI(1) - dimension max 1ØØ; outflow at initial time step, af/ft

TT - time at time step n for n = initial time to drawdown time

VOL1 - reservoir storage at initial time step, af

VOL2 - reservoir storage at end of time step, af

8. PROGRAM MESSAGES: Return from program message is to RERUN (another set of conditions) or STOP.

NEWTON METHOD DID NOT CONVERGE IN 2ØØ ITERATIONS - CHECK INPUT DATA

9. VARIABLE DEFINITIONS:

AA - temporary variable used in computing the gage height of the reservoir water surface at end of time step

AC - outlet conduit cross-sectional area, ft^2

AN1 - N value at beginning of time step (N_1)

AN2 - N value at end of time step (N_2)

B - temporary variable used in computing outflow

BB - temporary variable used in computing the gage height of the reservoir water surface at end of time step

CD - loss coefficient of outlet conduit

CI - constant inflow, af/ft

COEFFA - coefficient of power equation for gage height (ft) versus reservoir storage, af

COEFFB - coefficient of power equation for gage height (ft) versus reservoir storage, af

DELT - time step, hr

DH - difference between previous value of gage height at end of time step and the value of the new approximation, equation 15, ft

DQ - difference between outflow and inflow, af/hr

FH - functional relation (equation 12) in terms of gage height at end of time step

FHP - first derivative of FH, equation 13

FILEK(I) - 8 character, dimension max 2; I = 1 , name of input data file; I = 2 , name of output data file for graphics and/or other use

G - acceleration of gravity, 32.2 ft/sec^2

H1 - new approximation of gage height of reservoir water surface at end of time step, equation 14, ft

H2 - gage height of reservoir water surface at end of time step, ft

HF - final gage height of reservoir water surface, ft

HFILE - 5 character name of program (H2Ø5Ø); passed to WESLIB routine HACCT for bookkeeping; passed to WESLIB routine TACHFILE to verify that I/O files to be used are files for H2Ø5Ø

HI - initial gage height of reservoir water surface, ft

IPR - time step increment for printout, hr

JKL - directs return from WESLIB routine RERUN to desired input read

KFILE - file code; KFILE = 1 , file is an input data file; = 2, file is an output file

LQX - equal 1, print instructions from WESLIB routine RERUN; equal 3, no print

LQZ - equal 1, execute all manual input cues and reads; equal 2, call WESLIB routine RERUN and enter only desired inputs

NP - number of points on inflow hydrograph

NT - type of inflow; Ø - constant; 1 - hydrograph

01 - inflow at beginning of time step, af/hr

02 - inflow at end of time step, af/hr

OUTPUT - integer; type of output, 1 - detail; 2 - final conditions only

Q1 - outflow at beginning of time step, af/hr

Q2 - outflow at end of time step, af/hr

Q(I) - dimension max 1ØØ; inflow values of hydrograph, af/hr

T(I) - dimension max 1ØØ; time values of hydrograph

TT - time at time step n for n = initial time to drawdown time

VOL1 - reservoir storage at beginning of time step, af

VOL2 - reservoir storage at end of time step, af

ZZZZZ - 2 character; equal RE, rerun; equal ST, stop

10. EXAMPLE CASE: User has an existing hydrograph data file.

Input: Type of inflow (NT) = 1
File name (FILEK(1)) = HYDRO
Loss coefficient outlet (CD) = 16.2
Cross-sectional area (AC) = 16 ft^2
Initial gage height (HI) = 6Ø ft
Final gage height (HF) = 1Ø ft
Coefficients of power curve (COEFFA) = .Ø435;
(COEFFB) = 2.574
Type of output (OUTPUT) = 1
Time interval (IPR) = 12 hr
Save output for graphics and/or other use = NO

List of HYDRO

1ØØ H225Ø	19		12Ø	9.ØØ	14.38
1Ø2	Ø.	Ø.	122	1Ø.ØØ	13.22
1Ø4	1.ØØ	6.61	124	11.ØØ	11.57
1Ø6	2.ØØ	14.Ø5	126	12.ØØ	9.92
1Ø9	3.ØØ	21.49	123	13.ØØ	3.26
11Ø	4.ØØ	24.79	13Ø	14.ØØ	6.61
112	5.ØØ	22.31	132	15.ØØ	4.96
114	6.ØØ	19.83	134	16.ØØ	2.48
116	7.ØØ	13.18	136	17.ØØ	Ø.83
118	8.3Ø	16.53	138	18.ØØ	Ø.

Output:

```
H2250 - PESEPVOIP STOPAGE EVACUPATION TIME

AA - TYPE OF INFLOW; ENTEP 0 FOP CONSTANT INFLOW(MAY BE ZEPO) OP
ENTEP 1 FOP INFLOW HYDPOGPAPH(MAY BE FOLLOWED WITH CONSTANT INFLOW).
=1

DO YOU HAVE AN INPUT DATA FILE FOP INFLOW HYDPOGPAPH? Y OP N!
IF NO, WE WILL HELP YOU CPEATE FILE.
=Y
AF - FILE NAME
=HYDPO
AG - LOSS COEFFICIENT FOP OUTLET CONDUIT DEFINED BY:
K=2.*G*H/(Q/A)**2; WHEPE K=LOSS COEFF,G=ACCELEPATION OF
GPAVITY,Q=DISCHAPGE AND A=CPOSS-SECTIONAL APEA OF OUTLET CONDUIT.
=16.2
AH - CPOSS-SECTIONAL APEA(FT**2) OF OUTLET CONDUIT.
=16
AI - INITIAL GAGE HEIGHT AT WHICH DPAWDOWN BEGINS(FT. ABOVE
DATUM USED TO DETEPMINE OUTLET CONDUIT LOSS COEFF).
=60
AJ - FINIAL GAGE HEIGHT TO WHICH PESEPVOIP IS TO BE DPAWN DOWN
(FT. ABOVE DATUM USED TO DETEPMINE OUTLET CONDUIT LOSS COEFF).
=10
AK - COEFFICIENTS OF POWEP CUPVE FIT TO GAGE HEIGHT(FT) VS PESEPVOIP
VOLUME(ACPE-FT). FOPM OF EQUATION: Y=A*X**B; WHEPE Y EQUALS
VOLUME, X EQUALS GAGE HEIGHT AND A AND B APE THE COEFFICIENTS.
ENTEP A THEN B SEPEPATED WITH A COMMA.
=.0435,2.574
AL - DESIPED TYPE OF OUTPUT AS FOLLOWS:
    ENTEP 1 - DETAILED PPINTOUT OF GAGE HT., INFLOW, STOPAGE
              AND OUTFLOW FOP EACH INCPEMENTED TIME.
    ENTEP 2 - LIMITS OUTPUT TO INITIAL AND FINAL CONDITIONS ONLY.
=1
AM - TIME INTEPVAL FOP PPINTOUT.
NOTE: MUST BE EQUAL TO MULTIPLES OF 1 FOP CONSTANT INFLOW OP MULTIPLES
     OF TIME INTEPVAL OF THE INFLOW HYDPOGPAPH.
=12
AN - SAVE OUTPUT FOP GPAPHICS AND/OP OTHEP USE
=NO
```

TIME (HP)	GAGE HT. (FT)	INFLOW (AF/HP)	STOPAGE (AF)	OUTFLOW (AF/HP)
0.	60.00	0.	1642.29	20.42
12.00	59.20	9.92	1586.50	20.28
24.00	55.99	0.	1374.19	19.73
36.00	52.09	0.	1141.59	19.03
48.00	47.86	0.	917.39	18.24

60.00	43.18	0.	704.37	17.32
72.00	37.38	0.	502.84	16.23
84.00	31.63	0.	316.12	14.83
96.00	23.64	0.	149.34	12.82
108.00	10.07	0.	16.62	8.37
109.00	7.85	0.	8.75	7.39

RERUN OR STOP
=STOP

REF: ER 1110-1-10 - ENGINEERING AND DESIGN - Engineer and Computer Program Library Standards and Documentation, Appendix C

PART III: FILE DOCUMENTATION

1. REVISION LOG: N/A

2. TITLE: H225Ø - Reservoir Storage Drawdown Time

3. PROGRAM SOURCE LISTINGS: See pages 17-22

4. NUMERICAL AND LOGICAL ANALYSIS:

   First order (Newton) fixed point iteration technique is used to determine gage height of reservoir water surface at end of time step

5. SUBROUTINES NOT DOCUMENTED IN ABSTRACT: None

6. MISCELLANEOUS: The program is part of the CORPS computer system. CORPS is an acronym standing for Conversationally Oriented Real-Time Program-Generating System. The program is now operational on the WES G635, Vicksburg, MS; HIS 66/8Ø, Macon, GA; and Boeing CDC, Seattle, WA. The source listing on page 17 contains the first line run command and brief for H225Ø. This first line run command runs the binary H225ØB of the source listing on pages 18-22 (FORTRAN source of H225Ø) and attaches the WESLIB routines HACCT, TACHFILE, and RERUN.

02/06/79

H2250

```
0001*#RUN WESLIB/CORPS/H2250B,R;WESLIB/REPRT,R;WESLIB/TACHFILE,R;
0002*#WESLIB/HACCT,R
0300 62  THIS PROGRAM COMPUTES THE DRAWDOWN TIME (HR) FOR A RESERVOIR
0310 64WITH CONSTANT INFLOW (AF/HR) OR INFLOW HYDROGRAPH SPECIFIED WITH
0320 62THE GIVEN GAGE HEIGHT (FT) VERSUS STORAGE RELATION (AF). OTHER
0330 52INPUTS REQUIRED ARE THE CROSS-SECTION AREA (FT**2) AND LOSS
0340 60COEFFICIENT OF THE OUTLET CONDUIT AND THE LIMITS (FT) OF THE
0350 24WATER SURFACE ELEVATION.
0360 63  THE OUTPUT CONSIST OF A TABLE OF TIME (HR) VERSUS GAGE HEIGHT
0370 65(FT),INFLOW (AF/HR),STORAGE (AF) AND OUTFLOW (AF/HR) AS SPECIFIED
0380 47BY THE USER'S TIME INCREMENT (HR) FOR PRINTOUT.
0999*06FINISH
```

H2250

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H2250S

```
00001*#RUN *=;/CORPS/H2250B(NOGO)
10000 DIMENSION T(100),QI(100)
10010 COMMON /C77301/KFILE,FILEK(2),/MAIN/LOZ,LOM
10020 CHARACTER FILEK*8,HFILE*5,ZZZZZ*2
10030 INTEGER OUTPUT
10040 LOZ=1;LOM=1;HFILE=5HH2250;NCON=1;NHC=1
10050 PRINT 10033
10060 10033 FORMAT(/"H2250 - RESERVOIR STORAGE EVACUATION TIME"//)
10070 10034 CALL HACCT(HFILE)
10080 GO TO(10040,10846),LOZ
10090 10040 PRINT 1
10100 1 FORMAT("AA - TYPE OF INFLOW; ENTER 0 FOR CONSTANT INFLOW(MAY BE
10110&ZERO) OR"/"ENTER 1 FOR INFLOW HYDROGRAPH(MAY BE FOLLOWED WITH CONS
10120&TANT INFLOW).")
10130 10050 READ,NT
10140 IF(NT.NE.0) GO TO 2
10150 IF(NCON.EQ.1) GO TO 10100
10160 GO TO(10100,10846),LOZ
10170 10100 PRINT 4
10180 4 FORMAT("AB - CONSTANT INFLOW VALUE IN ACRE-FT/HR. IF NO INFLOW
10190&-ENTER 0.0.")
10200 10130 READ,CI
10210 NCON=2
10220 QI(1)=CI
10230 DELT=1.0
10240 GO TO 30
10250 2 GO TO(10175,10205),LOZ
10260 10175 PRINT 6
10270 6 FORMAT(/"DO YOU HAVE AN INPUT DATA FILE FOR INFLOW HYDROGRAPH?
10280& Y OR N!"/"IF NO, WE WILL HELP YOU CREATE FILE.")
10290 CALL ANSWER($500,$150)
10300 10205 IF(NHY.EQ.1) LOZ=1
10310 NHY=3
10320 GO TO(150,10846),LOZ
10330 150 PRINT8;LOZ=1
10340 8 FORMAT("AC - NEW INPUT DATA FILE NAME.")
10350 10230 READ 9,FILEK(1);LOZ=1
10360 9 FORMAT(A8)
10370 GO TO(10250,10346),LOZ
10380 10250 PRINT 10
10390 10 FORMAT("AD - NUMBER OF POINTS FOR HYDROGRAPH.")
10400 10270 READ,NP
10410 GO TO(10280,10846),LOZ
10420 10280 PRINT 11
10430 11 FORMAT("AE - PAIRS OF TIME(HRS) VS Q(ACRE-FT/HR) OF THE HYDROGR
10440&APH;"/"SEPERATE ALL VALUES WITH COMMAS. MAXIMUM NO.=100 AND TIME"/
10450&"INTERVAL MUST BE CONSTANT. FOLLOWING HYDROGRAPH THE PROGRAM ASSUM
10460&ES A"/"CONSTANT INFLOW EQUAL TO LAST Q VALUE OF THE HYDROGRAPH.")
10470 10330 READ,(T(I),QI(I),I=1,NP)
10480 KFILE=1
```

02/06/79

H2250S CONT.

```
10490 CALL TACHFILE(HFILE,$11784)
10500 WRITE(KFILE,270) NP,(I*2+100,T(I),QI(I),I=1,NP)
10510 CALL DETACH(KFILE,,)
10520 270 FORMAT("100 EVACU ",I3/(I3,2(1X,F10.2)))
10530 GO TO 20
10540 503 IF(MXO.NE.1) GO TO 20
10550 PRINT,"AF - FILE NAME"
10560 10410 READ 9,FILEK(1)
10570 KFILE=1;LOZ=2
10580 CALL TACHFILE(HFILE,$11784)
10590 REWIND KFILE
10600 IF(LOX.EQ.1) LOZ=1
10610 READ(KFILE,540,END=545) NP,(T(I),QI(I),I=1,NP)
10620 540 FORMAT(10X,I3/(3X,2(1X,F10.2)))
10630 545 CONTINUE
10640 CALL DETACH(KFILE,,)
10650 20 DELT=T(2)-T(1)
10660 30 IF(LOX.EQ.1) GO TO 35
10670 LOZ=2
10680 35 GO TO(10515,10846),LOZ
10690 10515 PRINT 13
10700 13 FORMAT("AG - LOSS COEFFICIENT FOR OUTLET CONDUIT DEFINED BY:"/
10710&"K=2.*G*H/(Q/A)**2; WHERE K=LOSS COEFF,G=ACCELERATION OF"/"GRAVITY
10720&,Q=DISCHARGE AND A=CROSS-SECTIONAL AREA OF OUTLET CONDUIT.")
10730 10550 READ,CD
10740 GO TO(10560,10846),LOZ
10750 10560 PRINT 14
10760 14 FORMAT("AH - CROSS-SECTIONAL AREA(FT**2) OF OUTLET CONDUIT.")
10770 10580 READ,AC
10780 GO TO(10590,10846),LOZ
10790 10590 PRINT 16
10800 16 FORMAT("AI - INITIAL GAGE HEIGHT AT WHICH DRAWDOWN BEGINS(FT.
10810& ABOVE"/"DATUM USED TO DETERMINE OUTLET CONDUIT LOSS COEFF..")
10820 10620 READ,HI
10830 GO TO(10630,10846),LOZ
10840 10630 PRINT 17
10850 17 FORMAT("AJ - FINIAL GAGE HEIGHT TO WHICH RESERVOIR IS TO BE DRA
10860&WN DOWN"/"(FT. ABOVE DATUM USED TO DETERMINE OUTLET CONDUIT LOSS C
10870&OEFF.")
10880 10660 READ,HF
10890 GO TO(10670,10846),LOZ
10900 10670 PRINT 18
10910 18 FORMAT("AK - COEFFICIENTS OF POWER CURVE FIT TO GAGE HEIGHT(FT)
10920& VS RESERVOIR"/"VOLUME(ACRE-FT). FORM OF EQUATION: Y=A*X**B; WHERE
10930& Y EQUALS"/"VOLUME, X EQUALS GAGE HEIGHT AND A AND B ARE THE COEFF
10940&ICIENTS."/"ENTER A THEN B SEPERATED WITH A COMMA.")
10950 10720 READ,COEFFA,COEFFB
10960 GO TO(10730,10846),LOZ
10970 10730 PRINT 19
10980 19 FORMAT("AL - DESIRED TYPE OF OUTPUT AS FOLLOWS:"/5X,"ENTER
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H2250S CONT.

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10990& 1 - DETAILED PRINTOUT OF GAGE HT., INFLOW, STORAGE"/16X,"AND OUTF
11000&LOW FOR EACH INCREMENTED TIME."/5X,"ENTER 2 - LIMITS OUTPUT TO INI
11010&TIAL AND FINAL CONDITIONS ONLY.")
11020 KOUT=1
11030 10780 READ,OUTPUT
11040 GO TO(10787,10846),LOZ
11050 10787 IF(OUTPUT.NE.1) GO TO 29
11060 IF(KOUT.EQ.1) GO TO 10800
11070 GO TO(10800,10846),LOZ
11080 10800 PRINT 12;KOUT=2
11090 12 FORMAT("AM - TIME INTERVAL FOR PRINTOUT."/"NOTE: MUST BE EQUAL
11100& TO MULTIPLES OF 1 FOR CONSTANT INFLOW OR MULTIPLES"/,6X,"OF
11110& TIME INTERVAL OF THE INFLOW HYDROGRAPH.")
11120 10840 READ,IPR
11130 29 GO TO(10850,10846),LOZ
11140 10850 PRINT,"AN - SAVE OUTPUT FOR GRAPHICS AND/OR OTHER USE"
11150 CALL ANSWER($11153,$11158)
11160 11153 NSAVE=1
11170 PRINT,"FILE NAME"
11180 KFILE=2
11190 11156 READ 9,FILEK(2)
11200 GO TO 11160
11210 11158 NSAVE=0
11220 11160 GO TO(11200,10846),LOZ
11230 10846 KKK=14
11240 CALL REPRT(KKK,LOX,JKL)
11250 GO TO(10080,10130,10230,10270,10330,10410,10550,10580,10620,10660,
11260&10720,10780,10840,11156,11200),JKL
11270 11200 PRINT 31
11280 31 FORMAT(//,2X,"TIME     GAGE HT.   INFLOW   STORAGE   OUTFLOW"/"
11290&  (HR)",7X,"(FT)",5X,"(AF/HR)",3X,"(AF)",5X,"(AF/HR)",/)
11300 NGF=0
11310 11225 H2=HI
11320 K=0
11330 G=32.2
11340 I=1
11350 B=0.08264*AC*SQRT(2.*G/CD)
11360 TT=0.0
11370 O1=B*SQRT(HI)
11380 VOL1=COEFFA*HI**COEFFB
11390 IF(NGF.EQ.1) GO TO 11322
11400 PRINT 34,TT,HI,QI(1),VOL1,O1
11410 GO TO 40
11420 34 FORMAT(F7.2,5X,F6.2,4X,F6.2,3X,F7.2,4X,F6.2)
11430 11322 WRITE(2,11323) TT,HI,QI(1),VOL1,O1
11440 11323 FORMAT(3F8.2,F10.2,F8.2)
11450 40 AN1=VOL1/DELT+O1/2.
11460 K=K+1
11470 IF(NT.NE.0) GO TO 45
11480 Q1=CI
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H2250S CONT.

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Q2=QI
45 IF(NT.NE.1) GO TO 50
IF(I.GE.NP) GO TO 51
Q1=QI(I)
Q2=QI(I+1)
GO TO 50
51 Q1=QI(NP)
Q2=QI(NP)
50 AN2=AN1-Q1+(Q1+Q2)/2.
AA=COEFFA/DELT
PB=P/2.
KK=0
55 FH=H2**COEFFB+(PB/AA)*SQRT(H2)-AN2/AA
FPH=COEFFB*H2**(COEFFB-1.0)+(BB*0.5/AA)/SQRT(H2)
H1=H2-FH/FPH
DH=ABS(H1-H2)
KK=KK+1
H2=H1
IF(KK.GT.200) GO TO 60
IF(DH.GT.0.01) GO TO 55
GO TO 65
60 PRINT 61
61 FORMAT(/"NEWTON METHOD DID NOT CONVERGE IN 200 ITERATIONS -
&CHECK INPUT DATA.")
GO TO 999
65 TT=TT+DELT
Q2=P*SQRT(H2)
VOL2=COEFFA*H2**COEFFB
DQ=ABS(Q2-Q2)
IF(OUTPUT.NE.1) GO TO 66
KK1=K/IPP*IPP-K
IF(KK1.LT.0.OR.KK1.GT.0) GO TO 68
67 IF(NGR.EQ.1) GO TO 11696
PRINT 34,TT,H2,Q2,VOL2,Q2
GO TO 66
11696 WRITE(2,11323) TT,H2,Q2,VOL2,Q2
66 IF(NGR.EQ.1) GO TO 11703
IF(OUTPUT.GE.2.AND.H2.LT.HF) PRINT 34,TT,H2,Q2,VOL2,Q2
GO TO 11710
11703 CONTINUE
11710 IF(H2.LT.HF.OR.DQ.LT..01) GO TO 999
68 IF(H2.LT.HF.OR.DQ.LT..01) GO TO 67
I=I+1
Q1=Q2
VOL1=VOL2
GO TO 40
999 LOZ=2
IF(NGR.EQ.1) CALL H2250I(OUTPUT,IPP,$11784)
IF(NSAVE.EQ.1) CALL H2250G(HFILE,TT,OUTPUT,IPP,NGR,$11784,$11225)
11784 PRINT 11785
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H2250S CONT.

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11735 FORMAT(//"RERUN OR STOP")
11430 READ,ZZZZZ
IF(ZZZZZ.EQ.2HRE) GO TO 10734
IF(ZZZZZ.EQ.2HST) GO TO 11430
PRINT,"AND MUST BE RERUN OR STOP"
GO TO 11430
11480 STOP
END
SUBROUTINE H2250G(HFILE,TT,OUTPUT,IPP,NGP,*,*)
COMMON /C77801/KFILE,FILEK(2)/MAIN/LOZ,LOX
CHARACTER FILEK*8,HFILE*5
INTEGER OUTPUT
KFILE=2
CALL TACHFILE(HFILE,$13220)
ND=TT;NW=TT;N2=1
13060 IF(ND.LE.200) GO TO 13080
N2=N2*2;ND=ND/N2;GO TO 13060
13080 NS1=OUTPUT;NS2=IPP
IPP=N2;OUTPUT=1
NW=NW-(NW/N2)*N2
IF(NW.GT.0) NW=1
ND=ND+1+NW
REWIND 2
WRITE(2,13120) (ND,I=1,5)
13120 FORMAT("10 H2250 05 25 EDGE"/"11 (05(/),(3F8.2,F10.2,F8.2))"
&/"12 ",I3,4(1X,I3)/"13",5("  1"))
WRITE(2,13150)
13150 FORMAT("14 CURVE DESIGNATIONS FOR H2250 ARE:"/"15  1=TIME
&2=GAGE HT   3=INFLOW"/"16  4=STORAGE   5=OUTFLOW"/"17 UNITS FOR AB
&OVE VARIABLES ARE:"/"18  HR=1   FT=2   AF/HR=3,5   AF=4")
NGP=1
RETURN 2
ENTRY H22501(OUTPUT,IPP,*)
IPP=NS2;OUTPUT=NS1;CALL DETACH(2,,)
13220 RETURN 1
END
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